

Interactive comment on “Source contributions of sulfur and nitrogen deposition – an HTAP II multi model study on hemispheric transport” by Jiani Tan et al.

Anonymous Referee #1

Received and published: 1 June 2018

This manuscript presents the results from the HTAP II multi-model study on the impact of hemispheric transport to the atmospheric deposition of S and N. Compared to HTAP I studies HTAP II has different definition of regions with higher spatial resolution which provides more accurate information for coastal regions. The manuscript falls within the scope of the journal and is suitable for publication in ACP after a number of corrections that will improve its clarity and are listed below:

- 1- Explain why the specific regions have been chosen for the study.
- 2- Title: Source contributions TO sulfur and nitrogen deposition. . .
- 3- line 34- abstract (but also elsewhere in the text)- west East Asia does not read nicely

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4- Line 42: 40% and 23-45% do not add up to 100%, where the remaining at least 15% comes from?

5- Line 68: remove 'to' after '3-5 ppb'

6- Line 77: 'significant'; can you derive a number or better a range of numbers for some pollutants from the publications? to quantify the 'significant' line 87: used

7- Line 160: please clarify whether for the NH₄⁺ wet deposition at stations you compared the modeled NH_x deposition with the NH₄⁺ wet deposition measurements, or the NH₄⁺ modeled only. The NH₄⁺ wet deposition measurements are representative of the sum of NH₄⁺ and NH₃ deposition.

8- Line 164: The most accurate comparison would have been that between atmospheric observations of gases and aerosols with the modeled concentration levels.

9- Lines 179-180: mass balance requirements. You need to provide more information specific to this study and mention here what tolerance you have for the mass balance. Is it for instance no tolerance at all? 1 per mile ? or higher? This means that you also need to define what means 'almost identical' (line 184).

10- Lines 185-186: Can you explain why the mass balance requirements are not fulfilled for one region while they are fulfilled for the others? What is the particularity of EA?

11- Line 211: please provide a comment on the sources that lead to injections of S emissions higher than NO_x emissions in the models. (relevant discussion line 315 – please provide some numbers)

12- Line 225: from the atmosphere

13- Line 226 'summer' do you mean winter?

14- Lines 227-228: indicate the region to which you refer?

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- 15- Line 231: IN our study
- 16- Lines 236-237: please rephrase in this sentence it is not clear which is what.
- 17- Line 239: comparable:
- 18- Lines 267-273: please comment on which circulations patterns contribute to these impacts.
- 19- Line 275: 'impact similar to that of S emission' does this mean similar lifetime of SO_x and NO_x ? if yes is this consistent with discussion in lines 211 and 315?
- 20- Lines 278-288: Could you comment on potential differences in aerosol pH that impact on the NO_y partitioning to the aerosol phase?
- 21- Lines 324-327: briefly describe the reported seasonality.
- 22- Line 328: replace 'due to that' by 'because'
- 23- Lines 361-364: can you discuss this based on atmospheric circulation ?
- 24- Line 381: 'other reasons' & line 388 'joint effects' : can you spell out potential reasons? Could this be change in oxidant chemistry and lifetimes for instance?
- 25- Line 397: separately
- 26- Lines 402-404 are very hard to read, please separate and rephrase this sentence for clarity
- 27- Lines 402-412: I think the units should be Tg(S)/yr or Tg(N)/yr.
- 28- Lines 427-429: you provide percentages for export of emissions from Europe to Russia and hen from Russia to Europe; similar for EA to RU and RU to EA, why you do not provide the net effect? Please rephrase for clarity.
- 29- Lines 429-430: remove 'to abroad' since it is export.
- 30- Line 447: do you mean that ' coastal regions receive upmost half of their deposition

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though hemispheric transport from foreign regions' or that 'half of the transported by LRT amount from foreign regions is deposited over the coastal regions' ?

- 31- Figure captions:
- 32- Line 745: correct MD to ME
- 33- Figure 1: why this figure does not show the upper boundaries of regions 3,4,14 and the Arctic?
- 34- Line 751: add per 0.1x0.1 deg grid box
- 35- Line 4: According to eq 1 the negative values should indicate increase in deposition with decline in emissions

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-109>, 2018.

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